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ABSTRACT

This paper describes the adaptation of instructional modules and audio-visual tapes for an engineering graphics course to a course entitled "Technical Drawing for Applied Art." This is a service course taught by the engineering department for the applied art department in the College of Home Economics. A separate problem package was utilized with the course text. Among the benefits of utilizing the tapes and modules were: (1) the tapes can be viewed by students who miss the lecture and (2) both can be used to review for quizzes and exams. The first tapes and modules were developed almost concurrently with the course. The modules have been utilized in teaching the course a total of seventeen times during four academic quarters and one summer session. The current materials represent a "second generation" effort. A written set of modules is currently being prepared, and this fall a handbook will be used instead of a text. A copy of the course objectives, the first module, and the narrative in the taped presentation are included. (LS)

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USE OF AUDIO-VISUAL CASSETTE TAPES AND INSTRUCTIONAL MODULES IN TEACHING GRAPHICS

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General

The use of new teaching methods and media do not automatically guarantee success. In the first place, using these new methods and media probably represents a major departure from your normal teaching style. This means a great amount of time and effort needs to be spent until you are comfortable with the new techniques. New media development takes much experimentation and time. Second, being new does not necessarily mean that your instructional efforts will be aided by new methods and/or media. They may not be adaptable to your material.

Background

I first became familiar with the combination of audio-visual tapes and instructional modules used to teach a course when Dr. Arv Eide of our department used them as part of his dissertation for his Ph.D. in Education. We subsequently used the combination of modules and tapes that he had prepared to teach a few sections of our first engineering graphics course, "Foundations of Engineering Graphics".

After utilizing the modules and tapes for the one course, I began to see how this system could be used to advantage for a course I was currently teaching. The course is titled "Technical Drawing for Applied Art", a service course we teach for the Applied Art department in the College of Home Economics.

Value for the Course

A text has been adopted and used for the classes for several quarters and is a good one. However, it has two basic drawbacks. It covered much

more material than could ever be covered in this course of study and was too advanced for a significant portion of the classes. A separate problem package has been utilized with the text giving the students opportunities to reinforce what had been learned.

A significant amount of time was spent during and outside of class by instructors going over very basic subjects and repeating material previously covered during the lecture. Any efforts expended to provide supplementary teaching materials would certainly be of value.

Our earlier experience with the tapes and modules provided us with some information regarding their value to the students. We found that using this combination of media provided these benefits:

1. Existence of the recorded lecture can serve as a remedial aid for the student in that the lecture can be reviewed to pick up material missed earlier.
2. The tapes can be viewed by students that miss the lecture. This is preferable to copying notes or getting a brief summary from the instructor.
3. The modules can be used to present additional material in written form.
4. The modules can be written following the same outline as the lecture, freeing the students attention from note taking to concentrate on the lecture.
5. The repetitive nature of the tapes and modules can be used effectively to reinforce the learning process.
6. Both can be used to review for quizzes and exams.

Initial Experience

The first tapes and modules were developed almost concurrently with the course (nearly all was done during my free time - no staff time was available). The modules have been utilized in teaching the course a total of 17 times over a time span of four academic quarters and one summer session. The tapes were used in place of a live lecture for two sections during the first quarter and as an outside reference since. (The taped lectures are on reserve in the media room at the library and can be checked out by students and used to review the material).

The current materials represent a "second generation" effort. The original modules were in an outline form, as opposed to a more completely written set currently being prepared. A completely revised set of tapes and modules will be used experimentally again this fall - this time without a formal text; just a handbook to be used as a reference.

Preparing of Objectives

Those who have obtained copies of this paper, may note that I have attached a copy of the course objectives and the first module.

The general objectives for the course were provided in rough form by the Applied Art department. They desired that their students learn the basic skills of hand lettering and instrument drawing, emphasizing good quality. In addition, some effort was needed in learning how to prepare multi-view drawings and to apply basic techniques of sectioning and dimensioning to these drawings. Primary emphasis was to be placed on pictorial drawings, particularly perspective drawings. Perspective is used as part of course work that follows.

These general objectives were rewritten into the following form:

1. Develop basic skills in drafting, including layout, line quality, use of equipment, and lettering.
2. Understand the essential features of orthographic projection and to apply them in delineating features of an object, using sectional drawings to illustrate interior features and correct dimensioning techniques for shape description.
3. Be able to distinguish between various types of pictorial systems and understand the relative advantages and disadvantages of each. Special emphasis is to be placed on the ability to understand and accurately represent an object with a perspective pictorial drawing.

The Modules

The list of topics to be taught in order to reach the preceding objectives is relatively short, making it possible to combine all material for each topic into one module. These were:

- Hand Lettering
- Use of Equipment
- Paraline Pictorials
- Multi-view Drawings
- Sectional Drawing
- Dimensioning
- Perspective

Since a major portion of the course is spent on perspective, it was

further divided into three sub-topics, making a total of nine modules for the course. These sub-topics are:

. Perspective - general

. Perspective - variables that control pictorial effect

. Perspective - short-cut techniques

Problems were developed specifically to be used to reinforce material covered in the modules and lectures. Additional problems were prepared to go with some of the modules to be assigned as extra work if needed.

Each module begins by a listing of a set of intermediate objectives for that topic - objectives to be met during the time spent on that module. Objectives of the first module were:

A. To demonstrate by application an understanding of the use of the Ames Lettering Guide and drawing pencils for lettering.

B. To illustrate without assistance the correct form of the various Gothic letters and the important rules of composition.

C. To develop a rate of lettering speed that will increase with practice, but will always maintain and demonstrate good quality.

That which follows represents a capsule of what we expect the students to learn. No extra material is included. A minimal number of illustrations are added for clarity.

The module is written using an outline form which could be used in the live lecture (and is in the taped one). Students are encouraged to use the module sheets for additional notes.

Quizzes and exams are prepared using the material covered in the modules and students are urged to use them as their primary study reference.

Audio-Video Tapes

The lectures developed by Dr. Eide were taped at WOI television studios on campus, using their equipment and professional staff. The format and some of the techniques used in these presentations were easily adapted to fit our needs in the Applied Art course. Unfortunately, there was not sufficient time available for adequate preparation so that we could use WOI. Therefore, the first tapes were prepared using a telectern, a Sony VO-1800 cassette recorder, and associated equipment located in one of our classrooms.

These lectures were rehearsed and taped without a class to focus on. The emphasis was on developing a one-to-one relationship; that the lecture was directed toward the viewer. The lectures followed the same outline as the modules, so that part of the preparation was not needed. I still needed from three to five hours for development of visuals and rehearsal per module plus one to two hours for taping. About twice that amount of preparation is needed for studio production. The tapes ran from 20 to 30 minutes each.

The time spent in preparation is the single biggest shortcoming. I feel that the taped lectures should be short and direct. The material should be presented in an efficient manner, without wasted motion. Student concentration seems to drop after 20 to 30 minutes. Extra preparation time is needed to accomplish this.

So that you can see something of the facilities available to us, I have prepared a short audio-video tape, divided into two parts. The first part was taped at WOI studios, the rest in one of our classrooms.

A taped presentation follows. The narrative included in the taped presentation is transcribed below.

"This is a demonstration audio-video tape produced at WOI-TV studios for this presentation. The electronic lettering is done by a character generator and can be used to replace lettered visuals prepared by hand or be used to add information to material already recorded".

Introduction:

There is no way that we can do more than to provide some inkling of the capabilities of a professional studio in recording learning material on Audio-visual tape. We are going to show something of both extremes: first, a taped segment produced using commercial equipment with professional assistance and another segment produced using equipment which can be used in a classroom, plus your own ingenuity, and whoever you can get to help with the camera.

We will demonstrate some techniques which are particularly useful in teaching graphics. Some of these you will see on the first segment and the balance in the second.

Visuals Aids

Visuals can be used to supplement drawings or pictures used in other teaching media (such as a text), to increase effectiveness of an oral presentation, or to assist in a demonstration. Whether color or black and white is used depends on your objectives and the material to be presented. Visuals are subject to some limitations not normally considered.

1. As in making a live presentation, only a limited amount of information can be shown at one time,
2. Ability to show detail (as is possible in a text) is limited due to the length of time a student has to see it, and
3. For best results, the shape of the finished visual should conform roughly to the ratio of height to width of the TV screen.

Demonstration

A common way of demonstrating techniques or a step-by-step approach to solving a problem is to set up a surface (such as a drawing board) and have a camera look over your shoulder as the work progresses.

Demonstrate this method by doing two or three procedures on the drawing board.

Multi-view Drawings

The preceding techniques used to present information visually are certainly not new or original. Many other techniques are possible, limited only by your imagination, that of the professionals helping you, equipment available, and time (a limited commodity). Here's one suggested by Red Varnum at WOI. By using a split screen and two cameras, the concept of multi-view drawings can be illustrated. (Hold up model, show it axonometrically, then orthographically.)

Summary

Whether you use this or any other technique should be decided on one basis - will it help the student to understand the concept better? Don't let your fascination with technique allow you to lose sight of your objective. Orient the material presented by means of the audio-video tape toward the student, and try to place yourself in his or her shoes.

As I said earlier, we can only scratch the surface in this limited time. We have done nothing with some other possibilities, such as putting in a segment of film which may be used to support your presentation or showing some slides.

Take care that the technique not take precedence over the material presented.

THAT'S ALL OF THIS SEGMENT, FOLKS

Segment 2 - Demonstration of tape production in a classroom.
The equipment used here can be used to produce a tape, to play a pre-recorded tape to be viewed and heard in up to seven classrooms, or to show a live lecture to each monitor in the classroom. It consists of a Sony VO-1800 cassette tape player-recorder (show) and a telectern with two cameras, an outboard which we're using now, and a fixed camera which receives an image reflected off a second surface mirror of an object on the working surface here.

The outboard camera makes it possible to record the appearance of the lecturer (so that the voice can be connected to a face) or to show visuals. The working surface and fixed camera are the most valuable (switch). Using this combination you can show something taken from a publication, or:

- Type large letters on a card to show titles
- Type smaller letters on a card of a definition
- Use drawings on a card to demonstrate a principal
- Show an illustration from a text - and use a pointer to indicate details as they are discussed. The Zoom can be used to call attention to certain features.
- A problem can be worked out ahead of time so that a solution can be shown without wasting time doing latout. See if you can see the light lines that I'm using to sketch an axonometric pictorial.

This telectern also has the capability of showing slides (demonstrate), or transparencies (demo.) - even overlay.

If you have any questions about the image being televised or recorded, just check the two monitors mounted conveniently above the working surface. Be prepared and rehearse ahead of time. Even though the tape can easily be erased and revised, you may tire of going through the lecture for taping. You should be prepared to go through the lecture without stopping, even though you can stop the recorder. It does leave a brief pattern on the tape where it is stopped.

Again, in only about three minutes, we cannot show you all the potential of a classroom studio, but I hope you may have picked up some

ideas. The visuals used in this presentation are simply prepared at your desk. If you have the time and inclination, you can always work to turn out something that will show up better.

THE END

Summary

It is difficult to do more than "skim the surface" during a 20 - 25 minute presentation. In this time, I have attempted to give you some idea of what we are doing. Our "second generation" effort, even though it should represent a major improvement over the first effort, is not the best we can do. There is potential for improvement that has not even been considered. I doubt that this will ever reach a point where we will be completely satisfied. More than likely, there will be an "energy" shortage first (I'll poop out).

The use of A-V tapes and modules together represent what you might call a "marriage of media". If your objectives are well defined, these media and/or others can be combined for more effective teaching. If you are a full-time teacher, not involved with research, it is appropriate that you should work in this direction. Certainly it represents one possible road toward improving the effectiveness of teaching in your department and thereby enhancing your value (which may lead to promotion).

I might say a few words about results so far. It is our feeling that limiting the range of material to be studied has enabled our students to reach the course objectives more easily and quickly. It seems that we keep asking the students to learn more and they respond by doing so.

Unfortunately, we do not have data to support this, but perhaps this could be a clue: we are seriously considering the possibility of adding a module to include new material. This would be used to extend the knowledge of the bright students who always seem to be done early -- and

express interest in learning additional material. This would be material never covered before, but would support existing course objectives.

One last comment. I have used the word "we" several times, and for a good reason. It is very helpful to have people who know the course material (and perhaps are currently teaching the course, using the same media) to critique the material, offer suggestions for improvement and add new ideas. I have been so blessed.

TECHNICAL DRAWING FOR APPLIED ART

A set of instructional modules designed to be used in conjunction with a supplementary text for teaching a course with the same title.

© Cletus R. Mercier, P.E.
Associate Professor
Freshman Engineering
Iowa State University

COURSE OBJECTIVES

1. Develop basic skills in drafting, including layout, line quality, use of equipment, and lettering.

2. Understand the essential features of orthographic projection and to apply them in delineating features of an object, using sectional drawings to illustrate interior features and correct dimensioning techniques for shape description.

3. Be able to distinguish between various types of pictorial systems and understand the relative advantages and disadvantages of each. Special emphasis is to be placed on the ability to understand and accurately represent an object with a perspective pictorial drawing.

PREFACE

The modules that follow are very brief, indicating basic concepts and illustrating some key points. Some additional outside reading will be assigned, particularly in your supplementary text. Please check your assignment sheet for details.

Course materials have been broken down into categories and major topics - one per module. Students can expect a major lecture over the material in the module plus problems assigned for reinforcement. Subsequent short lectures may follow depending on need.

Objectives for Module 1

A. To demonstrate by application an understanding of the use of the Ames Lettering Guide and drawing pencils for lettering.

B. To illustrate without assistance the correct form of the various Gothic letters and the important rules of composition.

C. To develop a rate of lettering speed that will increase with practice, but will always maintain and demonstrate good quality.

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INTRODUCTION

Lettering is a necessary part of most drawings. Generally, titles, sub-titles, names of elements, and notes are hand-lettered. Well constructed lettering can have positive effects on the appearance of the finished drawings.

1. Sizes of lettering can be varied from large sizes to emphasize data to the smallest readable size for minor notes.

2. A good rule of thumb is to use letters no smaller than 1/8" for notes (for drawings that will be neither enlarged nor reduced in size) nor larger than 3/16". A letter or numeral should have width or substance so it doesn't appear too weak.

3. Well-placed lettering can make a drawing simple and easy to understand.

Since lettering is a necessary element of graphical representation, it is important that it be clear, polished and attractive.

STYLE

There are many different styles of lettering. These include:

1. Gothic - An even, single width stroke set of letters, more uniform and standardized (See Plate 1A).

2. Roman - Letters made with "accented" strokes (thick and thin lines).

3. Text - Letters embellished and decorated - works of art.

Everyone inevitably develops an individual style of lettering. However, the most important characteristics of lettering are: neatness, readability, and consistency. Neatness and readability need not be explained. Consistency means:

1. don't mix styles
2. be consistent in the use of capital and lower case letters.
3. know the basic shape of each letter and execute it the same way each time.

Individual styles of lettering are best developed after learning and using one style. Since many feel that the most simple, basic shape is the most legible, the Gothic style of lettering will be used for this course. The lettering chart, shown on plate 1A illustrates the commercial, single-stroke Gothic letters and shows the complete alphabet and numbers, both capitals and lower case, vertical and sloped. Note particularly the proportions for each letter, clarified by the grids used as a background.

TECHNIQUE OF GOOD LETTERING

Good lettering is about 90% headwork and 10% handwork. These suggestions should be helpful in producing good lettering:

1. grasp the pencil lightly with a normal position of the thumb and fingers (too tight causes fatigue);
2. place the paper in such a position that the forearm is supported on the table or board;
3. use a firm stroke (not a sketch stroke), without exerting excessive pressure that may break the point or groove the paper;
4. do not tape the drawing down for lettering; instead turn the paper to an angle most comfortable for you.

There are five essential elements of good lettering - all beginning with the letter S (and worth remembering):

1. Size should be determined on the basis of readability and the proportional relationship - letters to size and scale of the drawing.
2. Shape - relationship of width to height, round letters uniformly round, proportions correct.
3. Space - refers to spacing between letters, not based on equal spacing between the extremeties of the letters (which can be scaled), but the area between letters (a matter of judgement). See the example below. It is a good rule to minimize the space between letters and to allow space between words of one full size letter.

MILK MILK

good poor

4. Slope - is either vertical or sloped. Whichever type is used should be uniform on the entire drawing. Sloped letters are done at a standard slope angle of about 68^0, or a ratio of 5 vertical to 2 horizontal.

5. Speed - an element which should be developed with practice, once the other 4 elements are learned.

EQUIPMENT

PENCILS

9H
8H
7H
6H
5H
4H — Very hard

3H
2H
H — Hard and dense: for layouts (construction lines), guidelines; good for accuracy (pencil stays sharp), not for finished drawings. Do not bear down hard-grooves paper and may not erase easily. Does not copy well.

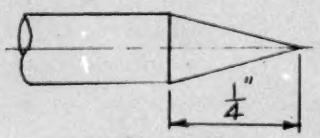
F — Medium

HB
B
2B — Soft

Freehand work, rendering

3B
4B
5B
6B — Very soft

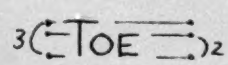
The best lead for normal lettering is H and 2H. Normal letters are best formed by a sharpened pencil. A mechanical pencil with a .5mm lead does not need sharpening, but the traditional leadholder with lead or wood pencil needs a well sharpened point. This can be accomplished with sandpaper, a steel file, or a mechanical pointer. For best results, the lead should be sharpened to a conical point, as shown below.

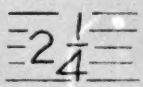


GUIDELINES

The use of guidelines is mandatory for letters to be consistent in height. They are a very light set of lines, just dark enough to be visible. A hard lead and a very sharp point is advisable. The "Ames Lettering Device" is a mechanical device which can be adjusted to provide guidelines for letters 1/16" to 5/16" in height. Normally, the row of holes labeled "2/3" is used for letters. Used in groups of 3, large and small capital letters can be combined such that the small letters are 2/3 the size of the large ones (See sample below). If numerals and fractions are to be used together, the

middle row (unlabeled) is used in combination of 5, making the fractions twice the height of the numbers (See below also). See instructions included with the device for assistance in its use.





Caution: Letters which extend <u>to</u> the guide line should <u>include</u> the line.

ERASER

The eraser included in the equipment list is plastic, will erase pencil lines easily, and will avoid marring the paper or ink lines nearby. A good rule is to use the softest eraser compatible with the job.

A B C D E F G H I J K L M N O P
Q R S T U V W X Y Z & &
a b c d e f g h i j k l m n o p q r s t u v w
x y z 1 2 3 4 5 6 7 8 9 0
A B C D E F G H I J K L M N O P
Q R S T U V W X Y Z & &
a b c d e f g h i j k l m n o p q r s t u v w
x y z 1 2 3 4 5 6 7 8 9 0

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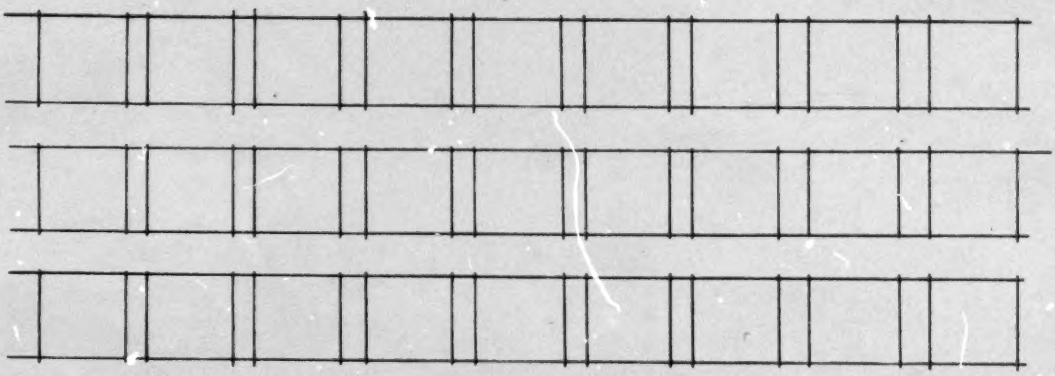
IOWA STATE UNIVERSITY STANDARD LETTERS & NUMERALS	COURSE: 121 DATE: 9-15- DR. BY: JOHN J. JOHNSON SECTION: 5 TABLE: 142 INSTRUCTOR: M.W. ALMFELTO	DR. NO. 1A GRADE:

Standard Letters & Numerals

1. The standard for lettering in this course will be vertical capitals using engineering standard form. In the spaces below letter each letter of the alphabet duplicating the standard form.



2. Practice letter form and spacing between letters by lettering the following words in large capitals. Remember to work for a uniform space (area), not distance, between letters. ENGINEERING, LETTERING, LILT, MINNESOTA, LAID.

3. Spacing between words should be very generous compared to spacing between letters within a word. Practice spacing, as well as letter form, by lettering the following sentence: GOOD LETTERING IS PRODUCED BY ABOUT 90% HEADWORK AND 10% HANDWORK (Use large and small capitals).

4. Whole numbers are the same height as full-sized letters, while fractions are double that height. Practice the form and spacing for numbers by lettering the following: 630, 1750, 8½, 53¾, 28-9/32 (A full size numeral will measure 3/16 inch).

Letter title strip below, using format shown on plate 1A. Draw in guidelines using hard pencil and marks provided.

COURSE: DATE: DR. BY: DR. NO. 1B

Composition - Vertical Capitals

1. Make 5 sets of guidelines for 3/16" letters. Letter the following groups on each line (repeat as necessary).

   Line 1: E A B F K C H M D

   Line 2: I N G L V J L W O

   Line 3: T X P Y Q R U Z J

   Line 4: 2 9 1 8 3 7 4 6 5

   Line 5: Numbers 1-10

2. Use guidelines for full-size letters of 1/4", letter the following numerals and fractions (remember, the total height of the fraction is twice the height of the numeral). 1 3/4, 1/2, 1/4, 10 1/2, 7 3/8, 9 5/16, 2 3/4.

3. Letter the following sentence using 1/8 inch high letters. 3H, 2H, and H pencils are generally used for outlines and lettering, HB, F and B for sketching, and 4H, 5H, and 6H for guidelines and construction lines.

4. Prepare and letter a well designed title block. Use three different sizes of letters to provide emphasis. Important items are made more prominent by use of larger letters. Include the following information: the name of your university or college, Technical Drawing for Applied Art, your name, and the date.

DR. NO.: 1C
GRADE:
DR. BY:
INSTRUCTOR:
DATE:
TABLE:
COURSE:
SECTION: